

REMARKS

Claims 25-27 and 29-52 are pending in this application. Claim 28 has been canceled without prejudice. Claims 1-24 were previously canceled without prejudice in the Preliminary Amendment filed June 17, 2003. Claim 25 has been amended to recite the feature of now-canceled claim 28, namely a product solid content of at least 53 wt.%. Support is found in the specification, *inter alia*, in claim 13 as originally filed. Claim 25 has also been amended to clarify that the mixing chamber forms part of a nozzle and is characterized in other respects as found in the specification, *inter alia*, in Figure 1.

New claims 48-50 and 52 have been added and recite additional features and characteristics of the nozzle. Support is found in the specification, *inter alia*, at page 7, line 23 to page 8, line 27. New claim 51 has been added and recites that the product comprises proteins, fats, minerals, and carbohydrates. Support is found in the specification, *inter alia*, at page 10, line 25 and claim 6 as originally filed.

Accordingly, the amendments add no new matter.

Applicant respectfully submits that the above amendments have been made to more clearly define and distinctly characterize the invention. Applicant's previous arguments of record provide additional and valid grounds for establishing the patentability of the claimed invention.

**The Rejections of Claims under 35 U.S.C. § 103**

The Office Action makes the following rejections under 35 U.S.C. § 103(a):

- claims 25-37, 40, and 43-45 over Johnston (U.S. Patent No. 2,401,077; “Johnston”) in view of Arndt (U.S. Patent No. 3,843,828; “Arndt”) and further in view of Rubens (EP 0 438 783; “Rubens”);
- claims 38 and 41 over Johnston, Arndt, Rubens, and further in view of Bond *et al.* (U.S. Patent No. 5,210,958; “Bond”)
- claims 39 and 46 over Johnston, Arndt, Rubens, and further in view of Scott *et al.* (U.S. Patent No. 3,925,560; “Scott”)
- claim 42 over Johnston, Arndt, Rubens, Bond, and further in view of Hovmand *et al.* (U.S. Patent No. 4,062,641; “Hovmand”)
- claim 47 over Johnston, Arndt, Rubens, and further in view of Bosund *et al.* (U.S. Patent No. 4,091,003; “Bosund”)

The rejection of claim 28 has been rendered moot by the cancellation of this claim.

Applicant respectfully traverses these rejections insofar as they apply to amended pending claims 25-27 and 29-47.

A *prima facie* case of obviousness requires three showings:

First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

Manual of Patent Examining Procedure, 8<sup>th</sup> ed., § 2142. These requirements of a *prima facie* case of obviousness are not met for any of the five rejections under 35 U.S.C. § 103(a).

A. THE APPLIED REFERENCES DO NOT DESCRIBE OR SUGGEST ALL CLAIMED FEATURES

To establish a *prima facie* case of obviousness, the prior art reference (or references when combined) must teach or suggest all the claim limitations. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991) (emphasis added). Amended independent claim 25 is (and dependent claims 26, 27 and 29-47 are) directed to methods for pasteurizing or sterilizing a product in liquid form which includes a heat sensitive substance. The methods comprise, *inter alia*, substantially atomizing the product in liquid form while admixing steam in a mixing chamber heated by steam. As recited in claim 25, the “mixing chamber form[s] part of a nozzle situated between inflow openings for steam and product in liquid form and an outflow opening.” The primary reference Johnston fails to describe or suggest this claimed feature, relating to the mixing chamber/nozzle configuration.

Importantly, none of the applied reference teaches or suggests this claimed configuration in combination with the following additional claimed features: a liquid product solids content of at least 53 wt.%; a mixing chamber residence time between about 0.2 msec and 20 msec; and a liquid product to steam weight ratio between about 1.6 and 10. For at least these reasons, the legal standard for a *prima facie* case of obviousness is not met.

Mixing Chamber/Nozzle Configuration

As stated above, Johnston does not teach or suggest the claimed mixing chamber/nozzle configuration, wherein the “mixing chamber form[s] part of a nozzle situated between inflow openings for steam and product in liquid form and an outflow opening.” In particular, from the single Figure of Johnston, the liquid product is sprayed into the steam chamber 13 from nozzle 14. Mixing of steam with product and atomization therefore take place after leaving the nozzle, not inside the nozzle. This is clearly different from the invention of amended claim 25, where

the chamber for atomizing liquid product while admixing steam actually forms part of the nozzle.

Johnston therefore discloses a conventional methodology for pasteurization/sterilization which is carried out by making use of a nozzle that does not comprise a mixing chamber. Such nozzles more or less correspond to the liquid product inlet (having a narrowed exit) represented by pipe 2 in Figure 1 of Applicant's specification. In the case of conventional nozzles, the liquid exiting pipe 2 is atomized directly into a drying chamber.

Similar to Johnston, Arndt also teaches the mixing of steam and liquid product, after leaving the nozzle, *i.e.*, the mixing chamber (or retention chamber in Arndt) does not form part of the nozzle. It is clear from the specification in Arndt that steam is mixed with the ejected suspension (*i.e.*, the suspension is ejected from the nozzle). See column 5, lines 10-11. Thus there is no teaching, suggestion, or motivation in either Johnston or Arndt to mix steam and product and atomize steam and product in a mixing chamber that forms part of the nozzle, as claimed.

In the case of the conventional methodologies described in Johnston and Arndt, Applicant has recognized that high concentrations of solids may lead to ineffective pasteurization/sterilization. It is contemplated that this is due to the fact that the liquid fraction of the product (usually water) evaporates too quickly, leading to slower or otherwise poorer atomization. Applicant has found this to be detrimental to pasteurization/sterilization, because of a reduced heat transfer. An additional consequence of poorer atomization is that the slurry may exit the mixing chamber in an undesirable string-like shape, such that it cannot be suitably dried. Pasteurization/sterilization using a conventional nozzle may in particular be ineffective in cases

where the liquid product comprises proteins, fats, carbohydrates, and minerals, or where the liquid product is an emulsion.

In contrast to the disclosure of Johnston, Applicant's claimed invention allows for the effective pasteurization/sterilization of a product in liquid form, where the product has a very high solids content and includes a heat sensitive substance. In particular, the nozzle as defined in amended claim 25 is such that the product (*e.g.*, from product inlet 2) is atomized in a mixing chamber 4, which forms part of the nozzle. Also, this mixing chamber is separated from a subsequent chamber, where the product may be dried. This mixing chamber is surrounded by steam (*e.g.*, from steam inlet 1) which is generally also atomized. See page 7, lines 27-28 of the specification. Applicant has discovered that this configuration, as now recited in independent claim 25, allows for effective heat transfer. Importantly, using the claimed invention, pasteurization or sterilization can be achieved within a residence time of only 0.2-20 ms.

Moreover, from the outlet of the nozzle (*e.g.*, exit 5), the atomized product may be led into a chamber 6, such as a drying chamber where liquid is allowed to evaporate from the product. Applicant has discovered further that drying in this manner can be carried out effectively and that formation of undesired string-shaped products is suppressed or even avoided.

While Figure 1 of Rubens depicts a nozzle, for the detailed reasons given below, there would have been no teaching, suggestion, or motivation for one of ordinary skill to combine any of the disclosure of Rubens with Johnston and/or Arndt (as proposed in the Office Action) with a reasonable expectation of success.

*Liquid Product Solids Content and Mixing Chamber Residence Time*

The applied references do not teach or suggest a way to pasteurize or sterilize a liquid product, which includes a heat sensitive substance and has a solids content of at least 53 wt.%,

where the residence time in the mixing chamber is between about 0.2 msec and 20 msec. Regarding any teachings as to the relationship between solids content and residence time, Johnston observes that some liquefied feed products such as milk are sterilized “inside of one or two seconds.” See page 3, right-hand column, lines 21-23. Applicant respectfully notes that the solids content of milk is well below 53 wt.%, and is actually about 13 wt.% for cow’s milk. Thus, at least this statement of Johnston fails to suggest any way to reduce the mixing chamber residence time to below one second for products having a significantly higher solids content than milk.

In this regard, Arndt similarly fails to teach or suggest the pasteurization of sterilization of liquid products having the solids content recited in the pending claims. In fact, Arndt even acknowledges that “above about 50 wt.% solids content, the increase in viscosity of the suspension makes further processing difficult.” See column 4, lines 18-20. Arndt thus clearly *teaches away* from modifying Johnston to increase the solids content. Applicant respectfully submits that it is not in the Office’s discretion to relegate the significance of these express, contrary teachings in the art, by referring to them as “a subjective opinion.” See the Office Action at page 5. From the above teachings in Arndt with respect to solids content, one of ordinary skill would clearly not have a reasonable expectation of modifying Johnston to successfully pasteurize/sterilize a liquid product having a solids content of at least 53 wt.%, as claimed.

Nor is there any teaching, suggestion, or motivation from Arndt to carry out a pasteurization/sterilization process with a residence time in the mixing chamber between about 0.2 msec and 20 msec. In this regard, Applicant notes that the residence time in the mixing chamber (retention chamber) of Arndt is from a few seconds to a few minutes, *i.e.*, at least a

factor of 100 higher that the residence times recited in the pending claims. Rubens similarly fails to teach the far shorter residence times claimed by Applicant. Rubens merely teaches that the residence time should be “sufficient to gelatinize the starch.” See page 4, lines 36-37. There is simply no disclosure or suggestion in this reference to use a residence time of about 0.2-20 msec, let alone any suggestion that such a short residence time would be suitable to effectively pasteurize or sterilize a product in liquid form having a solids content of at least 53 wt.%.

Moreover, like Arndt, Rubens teaches a solids content that is lower than that recited in the pending claims. Rubens states that the preferred starch content is 35-45%. No higher values are disclosed, and all working examples show a solids content well below 45%. Thus, there is no suggestion that the process of Rubens would be suitable for treating products having a solids content of at least 53 wt.%, let alone that such liquid products could effectively be pasteurized or sterilized.

For the above reasons, none of the applied references teaches or suggests the pasteurization or sterilization (or any other treatment) of a product in liquid form having the claimed solids content. At least one of the references, Arndt, in fact explicitly teaches away from solids contents higher than 50 wt.%. Nor is there any teaching or suggestion in any of the applied references to use the short residence times as claimed by Applicant for pasteurization or sterilization. As such, any contention that it would have been obvious from Johnston and Rubens to reduce the residence time is purely speculative. There is simply no suggestion in any of Johnston, Rubens, or Arndt that a residence time of at least 50-fold lower than disclosed in Johnston (who discloses the lowest residence time of the three references) would still be effective in pasteurizing/sterilizing any product, let alone a product with a solids content of at least 53 wt.%.

Liquid Product to Steam Weight Ratio

The applied references do not teach or suggest a liquid product to steam weight ratio between about 1.6 and 10, as claimed. For example, Arndt teaches “the amount of steam required is not great, normally being an amount which lowers the solids content of the suspension only about 1% to 3% by weight.” See column 5, lines 11-14. In contrast, the recited liquid product to steam weight ratio of the claimed invention is between about 1.6 and 10, corresponding to an amount of steam between about 10% and 38% by weight.

The Office Action at page 3 correctly calculates a product to steam weight ratio of 0.8, which is actually well below the minimum ratio recited in the pending claims. The Office Action goes on to state that the ratios can vary, but fails to point out any teaching, suggestion, or motivation in the art to increase this ratio to the claimed range of between about 1.6-10, as claimed. Applicant respectfully submits that such a motivation is completely lacking, especially considering that at least one reference, namely Arndt, actually teaches modifying this ratio in the opposite direction. Accordingly, one of ordinary skill would have no motivation from Rubens, whether taken alone or in any combination with Arndt or Johnston, to increase the product to steam ratios recited therein to arrive at the claimed values of between about 1.6-10. In making such a modification, there would have been no reasonable expectation of success in sterilizing or pasteurizing a product in liquid form having a solids content of at least 53 wt.% and including a heat sensitive substance.

In summary, Applicant has clearly distinguished the claimed invention over the disclosure of Johnston, in that Johnston does not teach or suggest the pasteurization or sterilization of liquid products having high solids content, *i.e.*, at least 53 wt.%, as now recited in independent claim 25. In fact, none of the applied references teaches or suggests such a high



solids content. Nor does Johnston teach or suggest other claimed features, including a mixing chamber residence time between about 0.2 msec and 20 msec, or even a liquid product to steam weight ratio between about 1.6 and 10. By the foregoing amendments, Applicant has now provided even a *further* basis of distinction over Johnston. In particular, Johnston fails to describe or suggest a “mixing chamber forming part of a nozzle situated between inflow openings for steam and product in liquid form and an outflow opening” as recited in independent claim 25. Neither Arndt, Rubens, Bond, Scott, Hovmand, nor Bosund, taken either alone or in any combination, cures all of the above-noted deficiencies of Johnston.

B. THERE WOULD HAVE BEEN NO MOTIVATION TO COMBINE THE  
TEACHINGS OF THE PRIMARY REFERENCE JOHNSTON WITH THE  
APPLIED SECONDARY REFERENCES

It is well established that a *prima facie* case of obviousness requires some suggestion or motivation to combine the reference teachings with a reasonable expectation of success. Manual of Patent Examining Procedure, 8<sup>th</sup> ed., § 2143. The applied references, Johnston, Arndt, Rubens, Bond, Scott, Hovmand, or Bosund do not meet this standard.

Regarding the proposed combination of Arndt with Johnston, the purpose of Arndt’s process, as well as Arndt’s process conditions, differ radically from Johnston’s process (and also from the claimed process). Thus, the skilled artisan would not have been motivated to combine Johnston and Arndt when seeking a solution to the problems known in the art (and discussed herein) related to the sterilization/pasteurization of liquid product having a solids content of at least 53 wt.%.

In particular, the disclosure of Arndt is directed to a completely different application, namely the removal of heat sensitive compounds and most notably volatile components. The conditions in Arndt’s process are taught to be such that weakening and/or breaking of bonds occurs between certain substances (*e.g.*, volatile flavorings and olfactory components) and

complex protein molecules. See column 4, lines 43-48. The skilled artisan would understand that such conditions would likely damage and/or remove heat sensitive substances, while Applicant's invention aims to *maintain* heat sensitive compounds. Because this purpose is directly at odds with the teachings of Arndt, one endeavoring to find the solution of Applicant's claimed invention would not consult Arndt for guidance.

Other vast differences between the disclosures of Arndt and Johnston provide further evidence to contradict any purported motivation to combine their teachings. For example, Johnston avoids the impact of steam with the atomized material (product). See page 3, left-hand column, lines 29-30. In direct opposition to these teachings of Johnston, Arndt explicitly states that "[e]ach tiny bit of suspension is instantly dynamically heated by the steam while practically simultaneously being subjected to severe physical forces at the nozzle and by the impacting steam." See column 4, lines 37-40.

The Rubens reference pertains to a process for gelatinizing starch. There is no indication in Rubens (nor would the ordinary skilled artisan have found any) that the teachings of this reference would be applicable at all to the pasteurization or sterilization of a liquid product which also includes a heat sensitive substance. The ordinary skilled artisan would have absolutely no reason to consult Rubens regarding how to confront the problem of effectively pasteurizing or sterilizing such a product, having a solids content of at least 53 wt.%, while preserving this heat sensitive substance. There is particularly no motivation from the teachings of Rubens to confront this problem using a residence time of only about 0.2-20 msec and using a product to steam weight ratio between about 1.6 and 10.

Because of the significant differences among the disclosures of the applied references, as discussed above, one of ordinary skill would not reasonably expect that conditions disclosed in

any one reference would be desirable or even useful in another. Thus, there is no teaching, suggestion, or motivation in the disclosures of Johnston, Arndt, or Rubens to combine their teachings, as necessary to make the rejections set forth in the Office Action. In fact, any such teachings originate from Applicant's own disclosure. The Office Action's assertion that the proposed combinations of references would have been obvious is therefore based purely on hindsight analysis, which is impermissible. *Texas Instruments Inc. v. U.S. ITC*, 988 F.2d 1165, 1178 (Fed. Cir. 1993). That is, the obviousness rejections of record are based on a judicious picking and choosing of features found in a diverse body of publications, using Applicant's own specification for guidance. No motivation can be found in the references themselves, as is legally required, for making these proposed selections of features.

#### CONCLUSION

There would have been no motivation for one of ordinary skill in the art to combine the applied references as proposed in the Office Action. However, even assuming *arguendo* that the proposed combinations were somehow legally proper, the applied references still fail to describe or suggest all claim limitations. The applied references therefore do not render obvious a method for effectively pasteurizing or sterilizing a product in liquid form having a solids content of at least 53 wt.% and including a heat sensitive substance, wherein the method comprises all features recited in amended independent claim 25.

For all of these reasons, the applied references therefore do not render independent claim 25 obvious. Claims 26, 27, and 29-47 depend from claim 25 and are therefore patentable over the applied references for at least the same reasons.

Reconsideration and withdrawal of the rejections are respectfully requested.

New Claims 48-52

The arguments set forth above apply with equal force to new claims 48-52. These claims depend from claim 25 and therefore not only incorporate the same elements but also recite additional features. For the reasons stated above, Johnston, Arndt, Rubens, Bond, Scott, Hovmand, or Bosund, taken either alone or in any combination, provide no teaching, suggestion, or motivation to pasteurize or sterilize a liquid product including a heat sensitive substance and having a high solids content, *i.e.*, at least 53 wt.%, using a mixing chamber residence time between about 0.2 msec and 20 msec and a liquid product to steam weight ratio between about 1.6 and 10, wherein the pasteurization or sterilization is performed by substantially atomizing the product while admixing steam in a mixing chamber that “form[s] part of a nozzle situated between inflow openings for steam and product in liquid form and an outflow opening.” Thus, new claims 48-52 are patentable over any combination of Johnston, Arndt, Rubens, Bond, Scott, Hovmand, and Bosund.

With respect to new claim 51 (and previously presented claim 34), Applicant respectfully submits that the problems mentioned above in the case of conventional nozzles (such as those disclosed in Johnston and Arndt) are particularly challenging where the product either is a stable emulsion or comprises proteins, fats, minerals, and carbohydrates. The applied references do not suggest that effective pasteurization or sterilization could be achieved in accordance with the present invention, for a product having the features recited in new claim 51 (or in pending claim 34).

With respect to new claim 52, Johnston fails to teach or suggest atomization of the steam. In fact, from Johnston’s description of “steam and atomized material,” it is apparent that the steam is *not* atomized. See page 3, left-hand column, line 20. Moreover, in contrast to the

recited feature of claim 52 "wherein the steam is atomized in the mixing chamber," Johnston actually *avoids* the impact of steam with the atomized material. See page 3, left-hand column, lines 29-30.

In view of the above amendments and remarks, all pending claims of this application are believed to be in condition for allowance. Acknowledgement of the same is respectfully requested.

This response is believed to completely address all of the substantive issues raised in the Office Action dated November 7, 2005.

Respectfully submitted,

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By: Benjamin C. Spehlmann Reg. # 45,649  
FOR John P. Iwanicki  
Registration No. 34,628

BANNER & WITCOFF, LTD.  
28 State Street, 28<sup>th</sup> Fl.  
Boston, Massachusetts 02109  
(617) 720-9600